



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Arild VIK Confirmation No: 7002
Appl. No. : 09/787,902
Filed : July 20, 2001
Title : PRODUCTION OF HYDROGEN AND CARBON WITH A
CARBON BLACK CATALYST

TC/A.U. : 1754
Examiner : S. Hendrickson

Docket No.: : ARIL3991/REF
Customer No: : 23364

APPEAL BRIEF 37 CFR §41.37

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This brief on appeal is submitted along with the required fee of \$500.00 under § 41.20(b)(2) for a large entity. The period for response has been extended to expire on February 1, 2005 by the filing herewith of a Petition for a Three Month Extension of Time and payment of the required fee.

Any additional fees necessary for this appeal may be charged against the undersigned's Deposit Account No. 02-0200.

41.37 (c)(1)(i). REAL PARTY IN INTEREST

The real party in interest is the Assignee of record PROTOTECH AS.

41.37 (c)(1)(ii). RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences with respect to the claimed invention which will directly affect or be directly affected by or have a bearing on the

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Board's decision in the pending appeal known to appellant, appellant's legal representative or assignee.

41.37 (c)(1)(iii). STATUS OF CLAIMS

This application contains 18 claims. Claims 1-4, 10-15 and 17 have been canceled from the application without prejudice or disclaimer. Applicant reserves the right to file a divisional application to the non-elected inventions and a further continuation to the canceled subject matter in the present application.

Claims 5-9, 16 and 18 are pending in the present application and have been finally rejected. Claims 5-9, 16 and 18 are the claims on appeal.

41.37 (c)(1)(iv). STATUS OF AMENDMENTS

An amendment was filed after final rejection **which sought to make clearer the recycling limitation on which Applicant's previous arguments had been based**. However, the proposed amendment to the claim was not entered as stated in the Advisory action because **it was deemed to [they] raise new issues**. The Advisory action states that the proposed Amendment is not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal.

41.37 (c)(1)(v). SUMMARY OF CLAIMED SUBJECT MATTER

The invention includes a method of energy efficient production of hydrogen and carbon by pyrolysis based on natural gas, methane or other organic gases as raw material. The method for precipitation of solid carbon is characterized by the use of **[finely distributed] carbon dust as catalyst for the precipitation process and especially by being a recycling process so that the gas passes through the chamber many times**. Carbon molecules from the gas attach to the catalytic particles causing growth

of these to a trappable size. The catalytic material is regenerated by continuous supply for finely crushed carbon from the process. (Page 1, lines 1-8.)

A method according to the invention significantly differs from the prior art [*by utilizing carbon dust as catalyst for splitting of hydrocarbons in an oxygen free environment. (Page 2, lines 19-21.)*] **in being a recycling process.**

The invention differs significantly from the prior art Patent DD 118263 by the fact that the **invention is a recycling process which allows** [*device and method is based on*] stationary carbon particles contained in compact reaction chamber. This makes it possible to produce a much more compact system compared to systems with moving particles or carbon deposition on surfaces. In addition, the new method is significantly more energy effective because the pyrolysis process operates at temperatures down to 400°C. (Paragraph bridging pages 2 and 3.)

The temperature in the reaction chamber (3) is **preferably** given an increasing gradient in the directional flow (from bottom to top) from 300 to maximum 2000°C. (Page 3, lines 11-13.)

The hydrogen-enriched gas is guided to a separation chamber where parts of the gas are separated through a membrane filter. The permeate fraction of the gas can be optimized with regard to the purity of the hydrogen. Before storage the gas is guided through a filter for removal of trace constituents. The retentate fraction of the gas from the separation chamber is returned to the inlet side of the reaction chamber. (Page 3, lines 21-27.)

Trapping of granulated carbon takes place continuously in the lower parts of the reaction chamber. As the catalytic particles grow and get trapped the system needs supply of new catalytic material. According to the invention, catalytic material is continuously produced by recycling, crushing and injection in the upper part of the reception chamber of a controlled fraction of the separated carbon. This [*recycling*] process maintains an optimum balance with regard to the amount and size of distribution of carbon particles. (Page 4, lines 5-11.)

41.37 (c)(1)(vi). GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 5-9, 16 and 18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 18 is unclear as to the meaning of 'down to'; as to whether this temperature (or a lower one) is required.

Claim 5 is unclear and inconsistent in that no recycling is recited.

In claim 9, 'fine' is subjective and unclear. Also, 'crushing' is incorrect- 'being crushed' appears correct.

Claims 5, 8 and 18 are rejected under 35 U.S.C. 102(b) as anticipated by the Voet et al. article.

Claims 5, 8 and 18 are rejected under 35 U.S.C. 103(a) as obvious over the Voet et al.

Voet teaches on pg. 135-136 decomposing methane to deposit carbon on particulate carbon. No mention is made of forming hydrogen, however this is deemed to occur since the hydrogen is not otherwise accounted for. The carbon substrate is 'micropulverized' to a size of 1800A which is deemed to be indistinguishable from 'dust'.

Claims 5-9, 16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over 118263.

The reference teaches in example 1 heating carbon particles by heat exchange from another process, then depositing carbon on them from the decomposition of a hydrocarbon. The product can be milled and recycled. The reference does not teach 'powder', however using a powder therein is an obvious expedient to provide a carbon source on which deposition can occur and which is fine enough to have a sufficient residence time for the reaction.

41.37 (c)(1)(vii). ARGUMENT

THE FORMALITY REJECTION

The rejection of claims 5-9, 16 and 18 under 35 U.S.C. 112, second paragraph, do not stand or fall together.

Applicant most respectfully submits that one of ordinary skill in the art will clearly take into consideration all aspects of the claimed invention as recited in claim 5. In this regard, the Examiner's attention is directed to MPEP §2173.02 Clarity and Precision. This section notes that the examiner's focus during examination of claims for compliance with the requirement for definiteness of 35 U.S.C. 112, second paragraph, is whether the claim meets the threshold requirements of clarity and precision, not whether more suitable language or modes of expression are available.

The essential inquiry pertaining to this requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. Definiteness of claim language must be analyzed, not in a vacuum, but in light of:

- (A) The content of the particular application disclosure;
- (B) The teachings of the prior art; and
- (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.

In reviewing a claim for compliance with 35 U.S.C. 112, second paragraph, the examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. 112, second paragraph, by providing clear warning to others as to what constitutes infringement of the patent<. See, e.g., *Solomon v. Kimberly-Clark Corp.*, 216 F.3d 1372, 1379, 55 USPQ2d 1279, 1283 (Fed. Cir. 2000). See also *In re Larsen*, No. 01-1092 (Fed. Cir. May 9, 2001) (unpublished) (The preamble of the *Larsen* claim recited only a hanger and a loop but the body of the claim positively recited a linear member. The court observed that the totality of all the limitations of the claim and

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their interaction with each other must be considered to ascertain the inventor's contribution to the art. Upon review of the claim in its entirety, the court concluded that the claim at issue apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function

In addition, MPEP §2111.02 Effect of Preamble should also be considered by the Examiner. This section of the MPEP provides clear guidance to the interpretation of the preamble in a claim. The preamble of claim 5 specifically requires a recycling process which needs to be taken into consideration in evaluating the patentability of the claims both under 35 USC 112 and 35 USC 102(b) as applied in the outstanding rejections on appeal. As stated in this section, "The determination of whether a preamble limits a claim is made on a case-by-case basis in light of the facts in each case; there is no litmus test defining when a preamble limits the scope of a claim. *Catalina Mktg. Int'l v. Coolsavings.com, Inc.*, 289 F.3d 801, 808, 62 USPQ2d 1781, 1785 (Fed. Cir. 2002). See *id.* at 808-10, 62 USPQ2d at 1784-86 for a discussion of guideposts that have emerged from various decisions exploring the preamble's effect on claim scope, as well as a hypothetical example illustrating these principles.

"[A] claim preamble has the import that the claim as a whole suggests for it." *Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 620, 34 USPQ2d 1816, 1820 (Fed. Cir. 1995). "If the claim preamble, when read in the context of the entire claim, recites limitations of the claim, or, if the claim preamble is 'necessary to give life, meaning, and vitality' to the claim, then the claim preamble should be construed as if in the balance of the claim." *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165-66 (Fed. Cir. 1999).

Claim 5 is clear and consistent and requires recycling

Claim 5 specifically recites a method of producing hydrogen and carbon in a recycling process as would be appreciated by one of ordinary skill in the art to which the invention pertains and is necessary for a proper interpretation of the claim. The preamble, in the present case, sets the stage for an interpretation of the claimed

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invention. It would clearly be appreciated by one of ordinary skill in the art to which the invention pertains that claim 5 claims a recycling process. This is clear from the specification and in particular the sentence at the bottom of page 3 wherein it is stated that the retentate fraction of the gas from the separation chamber is returned to the inlet side of the reaction chamber. As further noted in the last paragraph on page 4 of the specification, according to the invention, catalytic material is continuously produced by recycling, crushing and injection in the upper part of the reception chamber of a controlled fraction of the separated carbon. This recycling process maintains an optimum balance with regard to the amount and size distribution of carbon particles.

This purpose, set forth in the [preambles of the] claims themselves, "is more than a mere statement of purpose; and that language is essential to particularly point out the invention defined by the claims." *In re Bulloch*, 604 F.2d 1362, 1365, 203 USPQ 171, 174 (CCPA 1979).

Clearly, the recitation in the preamble is explicit in requiring recycling as would be appreciated by one of ordinary skill in the art and is evident from a reading of the specification. The recycling limitation in claim 5 has been improperly ignored as is evident from the Final Rejection. Accordingly, it is most respectfully requested that this rejection be withdrawn because the claim clearly requires recycling and is definite and clear to one of ordinary skill in the art to which the invention pertains.

Claim 9 is clear and in compliance with 35 U.S.C. 112

Applicant amended claim 9 in accordance with the Examiner's requirement in the amendment to the Final Rejection. However, the Amendment was not entered necessitating these arguments on appeal.

Applicant most respectfully submits that the context of the claim must be taken into consideration and the level of one of ordinary skill in the art considered in interpreting the claimed subject matter. Each word cannot be read out of context and when read in context with the claim, these rejected terms are definite and in full compliance with 35 U.S.C. 112.

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In particular, fine refers to the dust and one of ordinary skill in the art would understand the meaning of the expression "fine dust" and therefore it is most respectfully requested that this rejection be withdrawn. Also, crushing would be understood by one of ordinary skill in the art to mean that the trapped particles are crushed to a fine dust. Accordingly, it is most respectfully requested that this aspect of the rejection be reversed.

Claim 18 is clear as to the meaning of "down to"

The rejection of claim 18 as unclear with respect to the meaning of "down to" as to whether this temperature or a lower one is required should also be reversed. It is evident from Applicant's specification that the pyrolysis process operates at a temperature which is lower than those of the prior art and this would include down to 400°C. Accordingly, it is most respectfully requested that this aspect of the rejection be reversed.

THE PRIOR ART REJECTIONS

I. THE ANTICIPATION REJECTION

Claims 5, 8 and 18 are not anticipated by Voet et al. under 35 U.S.C. 102(b)

With respect to the anticipation rejection, Applicant wishes to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*,

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868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

In the Official Action it is urged that Voet teaches on page 136 decomposition of methane to deposit carbon on particulate carbon. It is recognized that there is no mention of forming hydrogen, however this is deemed to occur since the hydrogen is not otherwise accounted for. The carbon substrate is micropulvarized to a size of 1800Å which is deemed to be indistinguishable from dust. This rejection has been carefully considered but is most respectfully traversed as all of the claim limitations are not found in the reference.

Applicant most respectfully submits that it is not believed that the Examiner has properly appreciated the claimed invention and has not given appropriate weight to at least the recycling limitation recited in claim 5. It is believed that the Examiner's position is that recycling, which appears in the beginning of claim 5, is not considered as a limitation. [*This seems to be confirmed in view of the fact that claim 6, which the Examiner believes contains recycling, is not rejected over Voet et al.*] However, it is most respectfully submitted that recycling is a limitation in claim 5 for the reasons discussed above with respect to the rejection under 35 USC 112. Moreover,

[A] claim preamble has the import that the claim as a whole suggests for it." *Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 620, 34 USPQ2d 1816, 1820 (Fed. Cir. 1995). "If the claim preamble, when read in the context of the entire claim, recites limitations of the claim, or, if the claim preamble is 'necessary to give life, meaning, and vitality' to the claim, then the claim preamble should be construed as if in the balance of the claim." *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165-66 (Fed. Cir. 1999).

That is, the invention claimed in claim 5 resides in pyrolysing an organic gas by passing it through the heated reaction chamber and recycling it so that the gas passes through the chamber many times. Recycling is a claim limitation which cannot be ignored and clearly distinguishes the claim invention over the teachings of the Voet et

al. reference. Accordingly, it is most respectfully requested that the anticipation rejection over Voet et al. be withdrawn or reversed by the Board of Appeals.

Claim 18 does not stand with claims 5 and 8

Claim 18 does not stand with claims 5 and 8 since claim 18 states that the pyrolysis process operates at temperatures down to 400°C.

It is stated at column 2 of the Voet et al. reference that it is known that at 1050°C methane shows only negligible decomposition in the gas phase at residence times below 1 sec, but will decompose carbon on a carbon surface with preference to active sites. Since pores are necessarily active sites, we concluded that exposure to methane at 1050°C must lead to pore filling. There is no suggestion that the reaction may take place at a temperature down to 400°C. Again, this is a claim limitation not taught in the prior art and the rejection on the grounds of anticipation should be withdrawn.

II. THE OBVIOUSNESS REJECTIONS

Claims 5, 8 and 18 are not prima facie obvious in view of Voet et al. under 35 U.S.C. 103(a)

With respect to the obviousness rejection, Applicant wishes to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

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The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

In the Official Action it is urged that Voet teaches on page 136 decomposition of methane to deposit carbon on particulate carbon. It is recognized that there is no mention of forming hydrogen, however this is deemed to occur since the hydrogen is not otherwise accounted for. The carbon substrate is micropulvarized to a size of 1800Å which is deemed to be indistinguishable from dust. This rejection has been carefully considered but is most respectfully traversed as all of the claim limitations are not found in the reference and the necessary motivation to modify the teachings of the reference is not present in the prior art.

As just noted, Applicant most respectfully submits that it is not believed that the Examiner has properly appreciated the claimed invention and has not given appropriate weight to at least the recycling limitation recited in claim 5. This is clearly not provided for in the Voet reference which relates to the determination of t values. It is believed that the Examiner's position is that recycling, which appears in the beginning of claim 5, is not considered as a limitation. [*This seems to be confirmed in view of the fact that claim 6, which the Examiner believes contains recycling, is not rejected over Voet et al.*] However, it is most respectfully submitted that recycling is a limitation in claim 5 for the reasons discussed above with respect to the rejection under 35 USC 112. Moreover,

[A] claim preamble has the import that the claim as a whole suggests for it." *Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 620, 34 USPQ2d 1816, 1820 (Fed. Cir. 1995). "If the claim preamble, when read in the context of the entire claim, recites limitations of the claim, or, if the claim preamble is

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That is, the invention claimed in claim 5 resides in pyrolysing an organic gas by passing it through the heated reaction chamber and recycling it so that the gas passes through the chamber many times. Recycling is a claim limitation which cannot be ignored and clearly distinguishes the claim invention over the teachings of the Voet et al. reference. Accordingly, it is most respectfully requested that the obviousness rejection over Voet et al. be withdrawn or reversed by the Board of Appeals.

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It is stated at column 2 of the Voet et al. reference that it is known that at 1050°C methane shows only negligible decomposition in the gas phase at residence times below 1 sec, but will decompose carbon on a carbon surface with preference to active sites. Since pores are necessarily active sites, we concluded that exposure to methane at 1050°C must lead to pore filling. There is no suggestion that the reaction may take place at a temperature down to 400°C. Again, this is a claim limitation not taught in the prior art and the rejection on the grounds of obviousness should be withdrawn.

Claims 5-9 and 16 are not prima facie obvious under 35 U.S.C. 103 in view of DD 118263 A1

The rejection of claims 5-9 and 16 under 35 U.S.C. 103 as being unpatentable over DD 118263 A1 (hereinafter the '263 reference) has been carefully considered but is most respectfully traversed as not rendering the rejected claims prima facie obvious under 35 USC 103 for the reasons set forth in the discussion of this reference on pages

two and three of Applicant's specification, herein incorporated by reference, and the following reasons.

In the rejection it is urged the reference teaches in Example 1 heating carbon particles by heat exchange from another process then depositing carbon on them from the decomposition of a hydrocarbon. **It is also urged that** the product can be milled and recycled. The rejection acknowledges that the reference does not teach powder. However, using a powder therein is said to be an obvious expedient to provide a carbon source on which deposition can occur and which is fine enough to have a sufficient residence time for the reaction but does not provide any reason in support of this assertion which is specifically traversed. (Emphasis added.) Clearly, the assertion relies upon impermissible hindsight. *In re Fritch*, 23 USPQ 1780, 1784(Fed Cir. 1992) ("It is impermissible to engage in hindsight reconstruction of the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps.). Moreover, common knowledge and common sense of person of ordinary skill in the art is no good to reject under 35 USC 103(a); *In re Lee* 61 USPQ2d 1430 (CAFC 2002). This would hold for an "obvious expedient" which requires the citation of a reference which provides this teaching to one of ordinary skill in the art. Absent such a teaching it is clearly improper hindsight. Accordingly, this rejection should be reversed or withdrawn.

Furthermore the '263 reference fails to teach a recycling process in which the gas is passed through the chamber many times. This allows carbon dust to be used as the catalyst whilst still allowing the particles to grow to a trappable size since greater growth in particle size is achieved than with the single pass taught in the '263 reference.

Claim 9 does not stand or fall with claims 6-9 and 16

Applicant wishes to note that Applicant's comments with respect to Voet et al as noted above, apply to the '263 reference. The '263 reference discloses a pyrolysis process in which carbon particles are heated to a temperature in excess of 1000°C

before being injected into a hydrocarbon gas within a relative large reaction chamber. The transit time of the carbon particles through the reaction chamber is very short in such an arrangement as would be appreciated by one of ordinary skill in the art from the teachings of this reference. There is therefore little opportunity for the carbon particles to grow in size in accordance with the presently claimed invention (trappable size) as would also be fully appreciated by one of ordinary skill in the art to which the invention pertains. Furthermore, the relatively low rate of pyrolysis means that no hydrogen-rich gas stream is produced.

By contrast, the present invention involves heating the reaction chamber in which the carbon dust resides and further recites a recycling loop rather than the in-line arrangement taught in the '263 reference. In accordance with the invention, both carbon and hydrogen may be produced from the hydrocarbon fuel thus extending the range of possible uses and commercial potential of the system. The invention allows a much higher rate of pyrolysis as the amount of active carbon per unit volume may be orders of magnitude higher. Accordingly, it is most respectfully requested that this rejection be withdrawn.

CONCLUSION

In view of the above arguments, the rejection of the claims on appeal should not be sustained. The prior art rejection should be reversed and the application passed to issue.

Respectfully submitted,
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41.37 (c)(1)(viii) Claims appendix

5. A method of producing hydrogen and carbon in a recycling process by pyrolysis of an organic gas utilising carbon dust as a catalyst for precipitation of carbon characterised by stimulating carbon precipitation by guiding the gas through a heated reaction chamber where the carbon molecules from the gas can attach to the catalytic particles causing growth of these to a pre-set size that can be mechanically trapped.

6. A method as claimed in claim 5 characterised by crushing a controlled amount of precipitated carbon and returning the crushed carbon to the reaction chamber in a continuous process for maintenance of an optimum balance with regard to the amount and size distribution of carbon particles.

7. A method as claimed in claim 5 comprising heating said reaction chamber using excess heat from another process.

8. A method as claimed in claim 5 comprising heating said reaction chamber to a temperature of between 300 and 2000°C.

9. A method of pyrolysis of an organic gas comprising passing said gas through a heated reaction chamber containing carbon dust such that carbon from said gas is caused to precipitate onto said carbon dust causing growth of the size of the carbon particles to a trappable size, removing said trapped particles from the heated reaction chamber, and returning a portion of said trapped particles after crushing to a fine dust to the heated reaction chamber.

16. A method as claimed in claim 6 comprising heating said reaction chamber using excess heat from another process.

18. A method as claimed in claim 5 wherein the pyrolysis process operates at temperatures down to 400°C.